

BELLCOMM, INC.

SUBJECT: Follow-Up Report: On-Pad Crew
Safety - Cases 320 & 330

DATE: October 18, 1966

FROM: P. R. Knaff
L. G. Miller

ABSTRACT

As a follow-up to an earlier memorandum, this report provides a more recent picture of the status of developments concerning on-pad crew safety. Definite progress has been made during the past month in the areas of operations and training. Modifications to egress hardware in support of AS-204 also appear to be progressing satisfactorily.

Additional training for Pad Egress Team members is being planned in support of the AS-204 mission. A preliminary document covering pad evacuation prior to CM closeout has also been issued, but substantial reworking will be required before it achieves final form.

The most important area that still remains open is the generation of a comprehensive plan which brings together all prelaunch operations affecting flight crew safety. The Flight Crew Egress Procedures Plan, expected on November 1, and the Pad Evacuation Plan will be combined to form the major elements of this comprehensive treatment.

Work on a complementary activity, involving categorizing the major types of on-pad contingencies, is currently underway. Specifying the response to these on-pad contingencies has yet to be accomplished. The recent slip of the AS-204 launch date may provide sufficient time to resolve the major planning items still open.

FACILITY FORM 602

(ACCESSION NUMBER)	(THRU)
7	2A
(PAGES)	(CODE)
CR-81072	11
(NASA CR OR TMX OR AD NUMBER)	(CATEGORY)

(NASA-CR-153767) FOLLOW-UP REPORT: ON-PAD
CREW SAFETY (Bellcomm, Inc.) 7 p

N79-72046

00/14 Unclas
12348

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MEMORANDUM FOR FILE

I. INTRODUCTION

A recent memorandum¹ considered the status of the subject of on-pad crew safety. The memorandum was divided into three sections which examined operations, hardware, and training. It was concluded that the hardware would be able to support the AS-204 mission if proposed changes were completed. In the areas of operations and training, however, several significant open items were noted. The purpose of this memorandum is to provide a more recent picture of the status of these items and other developments concerning on-pad crew safety.

II. OPERATIONS

In the original memorandum reporting the status of this subject, it was pointed out that flight crew safety must be considered from the time that the crew arrives at the launch complex. It was further noted that the Emergency Egress Working Group (EEWG) of ALOC only considered the period of time that began with "hatch closeout." Thus, of the 195 minutes² during which the crew is exposed to pad hazards, only the last 30 (about 15% of the total exposure) are actively being covered by the EEWG. To remedy this situation, it was recommended that the EEWG extend their "interval of concern" to the time at which the crew reaches the pad. During their meeting on October 14, the EEWG conceded that it was necessary to consider crew safety beginning with the time of crew arrival, but felt that a more pressing need existed to finalize the AS-204 egress procedures. As a result, discussions on extending their time period of concern were postponed until a future meeting.

¹"Status Report: On-Pad Safety - Case 320," Memorandum for File, dated September 29, 1966, by P. R. Knaff, L. G. Miller and M. M. Purdy.

²The original memorandum used 90 minutes as total crew exposure time. Recent information indicates that the flight crew will be at the launch complex at approximately T-195 minutes for AS-204.

On October 18, a preliminary plan was received by the Chairman of the EEWG covering evacuation of the closeout crew during the period extending from T-210 to T-30 minutes. This pad evacuation plan is being critiqued in detail, but a first look indicates a need for extensive modification. Informally, at least, some effort will be made to integrate closeout crew and flight crew safety provisions during the entire period of concern.

The September 29 memorandum recommended that the number of personnel on the umbilical tower after flight crew insertion be limited to minimize the time during which more than one elevator trip would be needed to evacuate all personnel. The recently generated pad evacuation plan reflects the necessity to limit tower personnel. Thus, if an evacuation is required, it is planned that one elevator trip will be sufficient to empty the tower.

The October 14 meeting of the EEWG also saw the adoption of revised definitions for Emergency Condition and Hazardous Condition. This does not represent a change in philosophy since the definitions only serve to explain the conditions under which an Emergency Abort or a Hazardous Egress should be performed. The revised definitions are as follows:

Emergency Condition - An abnormal condition in or around the space vehicle or launch complex which represents an imminent catastrophe. Sufficient time is not available to (safely) egress via the access arm. Emergency abort will be initiated.

Hazardous Condition - An abnormal condition in or around the space vehicle or launch complex which poses a threat to flight crew health or safety. A hazardous condition may deteriorate into an emergency condition. The distinction is that a hazardous condition implies that there is sufficient time available for the flight crew to (safely) egress via the access arm or for the flight crew to remain in the command module until the hazardous condition is corrected.

As before, three types of hazardous egress are possible: Unaided, aided, and aided incapacitated. They remain unchanged.

As originally conceived, the Launch Operations Manager had the responsibility to decide whether an emergency abort or a hazardous egress was to be performed. In the latter case,

he had the responsibility of also calling the type of egress. In the last month, some discussion was given to splitting these responsibilities so that, while the Launch Operations Manager was responsible for requesting an emergency abort, the Launch Director would have the responsibility for initiating the various hazardous egress modes. Although such a division of responsibilities might work, its inherent difficulties should be noted. Two major problems are that:

1. It would be possible simultaneously to initiate a hazardous egress and an on-pad abort.
2. The responsibility for flight crew safety is shifted to the Launch Director when the Launch Operations Manager decides that no emergency exists at that instant. On the other hand, there is no ready and direct source of information to enable the Launch Director (who then has the responsibility) to ascertain that the hazard is degenerating into an emergency and to re-transfer his responsibility for crew safety back to the Launch Operations Manager.

The unwieldiness described above is the strongest argument against splitting the decision function. For this reason, the EEWG recommended that the original plan, in which the Launch Operations Manager is responsible for calling both egress and on-pad aborts, remain in effect. One suggested change was kept, however. In calling the emergency egress, the Launch Operations Manager was to obtain the concurrence of the Launch Director. The requirement for this concurrence does not conflict with the time-frame required to call egress.

Subsequent discussions between the Launch Director and members of the EEWG resulted in the adoption of the following scheme:

Responsibility of Launch Director

The Launch Director is responsible for initiating flight crew hazardous egress through the Launch Operations Manager, including specification of the egress mode.

Responsibility of Launch Operations Manager

The Launch Operations Manager is responsible for implementation of flight crew egress through the test supervisor.

The Launch Operations Manager is responsible for continued monitoring of hazardous conditions and for initiation of changes in the mode of flight crew egress or stopping egress operations in the event that it appears the hazardous condition may deteriorate to an emergency condition.

The September 29 memorandum also noted that, at that time, there had been no compilation of pad hazards and the appropriate actions to be taken for each. In view of the obvious utility of such planning, it was recommended that steps should be taken to outline, in some fashion, the major categories of on-pad contingencies requiring egress or abort. Activities along this line have been taking place recently at KSC, and it is expected that a list of contingencies will have been outlined prior to AS-204. Planning the "best reaction" to each contingency, which is the next logical step, should take place at KSC prior to AS-204; however, the scheduling of this activity is not yet available.

III. HARDWARE

Two previously open hardware items have been resolved since the September 29 date of the original memorandum. The shower tunnel, located at the base of the umbilical tower, has been tested and found to be satisfactory. For all future flights, the shower tunnel will be functionally tested a few days prior to launch. The possibility of providing redundant relay control circuitry for the egress elevator was also investigated by KSC. They have reported that complete redundancy is not possible for AS-204, nor do they recommend it for future flights.

IV. TRAINING

Problems in the training area were noted in the September 29 memorandum. These centered largely about the lack of training facilities for Pad Egress Team (PET) members. Previous information indicated that a CM mock-up would be sent to KSC for PET training purposes. Supposedly, this referred to the Block I CM mock-up at NAA, Downey, which is presently in a CM 014 configuration. It now appears that the Block I crew couches will be removed from the mock-up and shipped to Wright-Patterson AFB for use in conjunction with zero-G testing. At the conclusion of those tests (approximately three weeks duration), the couches will probably be returned to NAA. It appears that the Block I mock-up will be shipped to MSC for flight crew training purposes. Presently, there does not appear to be any plan for providing an egress training mock-up for KSC.

Due to lack of an egress training mock-up at KSC, plans are proceeding for additional PET training at MSC. The PET commander for AS-204, two firemen and two paramedics are to participate in the training. In addition, there will be representatives from the EEWG (from both KSC and NASA Headquarters) and two members of the Landing and Recovery Division (FL) of MSC. The training will undoubtedly precede the AS-204 Overall (plugs out) Test, but a date has not yet been established.

V. CONCLUSIONS

Definite progress has been made during the last month toward improving on-pad crew safety. Modifications to egress hardware in support of AS-204 appear to be progressing satisfactorily. Although a CM mock-up will not be shipped to KSC for PET training, plans have been made to train PET members on a Block I CM mock-up at MSC. While only a small number of PET members will be involved in this exercise, the actual experience they will gain with CM hardware represents a distinct step forward. For AS-204, the PET apparently will be sufficiently trained to support the mission.

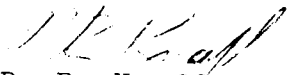
The EEWG has recognized the need to extend their time period of concern to begin with flight crew arrival at the pad. Formal acknowledgment of this necessity in the form of an amended charter is expected in the near future.

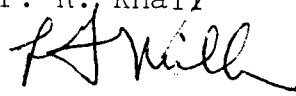
KSC recognition of one aspect of early prelaunch contingencies is reflected in a recently issued, preliminary document covering pad evacuation prior to CM closeout. Among other considerations, the plan indicates the need to limit the number of personnel on the umbilical tower after propellant loading. If the requirements outlined in the plan are fulfilled, only one elevator trip will be necessary to empty the umbilical tower of personnel if a hazardous egress should become necessary prior to hatch closeout. Although this preliminary document requires substantial reworking before it achieves final form, activities directed at this goal are currently underway.

The most important area that still remains open is the generation of a comprehensive plan which brings together all prelaunch operations affecting flight crew safety. The pad evacuation plan, mentioned in the preceding paragraph, and the flight crew egress procedures plan, expected on November 1, will be combined to form the major elements of this comprehensive treatment.

Work on a complementary activity, involving categorizing the major types of on-pad contingencies, is currently underway. Specifying the **response** to these on-pad contingencies has yet to be accomplished. The recent slip of the AS-204 launch date may provide sufficient time to resolve the major planning items still open.

2022 PRK
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